IN THE CLAIMS

Please amend the claims as follows:

1.   (Currently Amended) A method for real-time encoding of an audio signal in an audio encoder, comprising:

grouping spectral lines to form scale band factors by determining masking thresholds based on human perception system using a time-to-frequency transformation module of the audio encoder;

calculating local gain for each scale band factor using a quantizer coupled to a processor in the audio encoder;

shaping quantization noise in spectral lines in each scale band factor using its local gain using a the quantizer coupled to a processor in the audio encoder, wherein the local gain of the each scale band factor are is estimated as a function of band energy ratios and SMRs, wherein the shaping the quantization noise in each scale band factor such that a difference between SMR and SNR in each scale band factor is substantially constant, and wherein the energy ratios are computed by dividing energy in each band over sum of energies in all bands, and wherein the local gain in each scale band factor is derived using the equation:

$$K_b=-(int)(a * log2(en(b)/sum\_en) + \beta* log2 (SMR(b)))$$

wherein K_b is the local gain for each band, *log2* is logarithm to *base 2*, *en(b)* is the band energy in band *b, sum_en* is total energy in a frame, *SMR(b)* is the psychoacoustic threshold for band b, wherein *a* measures weightage due to energy ratio, and β is a weightage due to SMRs; and

running a loop for each scale band factor to satisfy a predetermined bit allocation rate based on a bit allocation scheme using an inner loop module of the audio encoder.

2.   (Canceled)

3.   (Canceled)

4.   (Previously Presented) The method of claim1, wherein shaping the quantization noise in each scale band factor such that the difference between SMR and SNR is substantially constant comprises:

      assigning a higher quantization precision to scale band factors having a high SMR; and

      assigning quantization precision to each scale band factor that is inversely in proportion to their energy content with respect to frame energy to desensitize the scale factor bands.

5.   (Canceled)

6.   (Canceled)

7.   (Canceled)

8.   (Canceled)

9.   (Canceled)

10.   (Canceled)

11.   (Previously Presented) A single-loop quantization method for band-by-band coding of an audio signal in an audio encoder, comprising:

      calculating local gain for each band using a quantizer coupled to a processor in the audio encoder; and

      shaping quantization noise in each band using its local gain using the quantizer, wherein the local gain in each band is derived using the equation:

$$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2 (SMR(b)))$$

wherein K_b is the local gain for each band, *log2* is logarithm to *base* 2, *en(b)* is the band energy in band *b, sum_en* is total energy in a frame, *SMR(b)* is the psychoacoustic threshold for band b, wherein *a* measures weightage due to energy ratio, and β is a weightage due to SMRs.

12.　　(Currently Amended) A method for encoding an audio signal in an audio encoder, based on a perceptual model, comprising:

calculating local gain for each scale band factor using a quantizer coupled to a processor in the audio encoder; and

quantization noise shaping of spectral lines on a band-by-band basis using the local gain using a the quantizer ~~coupled to a processor in the audio encoder~~, wherein the local gain of ~~the~~ each band ~~are~~ is estimated as a function of band energy ratios and SMRs such that a difference between SMR and SNR is held substantially constant for each band, wherein the energy ratios are computed by dividing energy in each band over sum of energies in all bands, and wherein the local gain in each scale band factor is derived using the equation:

$$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2\ (SMR(b)))$$

wherein K_b is the local gain for each band, *log2* is logarithm to *base* 2, *en(b)* is the band energy in band *b, sum_en* is total energy in a frame, *SMR(b)* is the psychoacoustic threshold for band b, wherein *a* measures weightage due to energy ratio, and *β* is a weightage due to SMRs.

13.　　(Canceled)

14.　　(Canceled)

15.　　(Original) The method of claim 12, wherein the quantization noise shaping of each scale band factor such that the difference between SMR and SNR is substantially constant comprises:

assigning a higher quantization precision to bands having a high SMR; and

assigning a quantization precision to each band that is inversely in proportion to their energy content with respect to band energy to desensitizing the bands.

16.　　(Original) The method of claim 15, wherein fitting the noise shaped spectral lines comprises:

estimating a bit demand for each band: and

allocating the estimated bit demand based on a predetermined bit rate.

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111   **Page 5**
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17.   (Canceled)

18.   (Canceled)

19.   (Canceled)

20.   (Previously Presented) An apparatus comprising an encoder including a quantizer coupled to a processor to quantize an audio signal based on a perceptual model comprising calculating local gain for each band and quantization noise shaping of spectral lines on a band by-band basis using the local gain, wherein the quantization noise shaping the spectral lines on the band-by-band basis such that the difference between SMR and SNR is substantially constant in each band, wherein the local gains are derived using the equation:

$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2 (SMR(b)))$

wherein K_b is the local gain for each scale band factor, *log2* is logarithm to *base* 2, *en(b)* is the band energy in scale band factor *b*, *sum_en* is the total energy in a frame, *SMR(b)* is the psychoacoustic threshold for scale band factor *b*, wherein *a* measure weightage due to energy ratio, and *β* is the weightage due to SMRs; and

fitting spectral lines within each band based on a given bit rate.

21.   (Currently Amended) An apparatus for coding a signal based on a perceptual model, wherein the apparatus includes an audio encoder including a quantizer coupled to a processor, comprising:

means for calculating local gain for each scale band factor using the quantizer coupled to the processor in the audio encoder;

means for shaping quantization noise in spectral lines on a band-by-band basis using the local gain using the processor, wherein the local gain of the each band are is estimated as a function of band energy ratios and SMRs, wherein the means for shaping quantization noise in the spectral lines such that the difference between SMR and SNR is substantially constant for

each band, ~~and~~ wherein the energy ratios are computed by dividing energy in each band over sum of energies in all bands, and wherein the local gain in each scale band factor is derived using the equation:

$$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2\ (SMR(b)))$$

wherein K_b is the local gain for each scale band factor, *log2* is logarithm to base 2, *en(b)* is the band energy in scale band factor *b, sum_en* is the total energy in a frame, *SMR(b)* is the psychoacoustic threshold for scale band factor *b*, wherein *a* measure weightage due to energy ratio, and β is the weightage due to SMRs; and

means for quantizing the shaped spectral lines in each band based on a predetermined bit rate.

22.   (Original) The apparatus of claim 21, further comprising:

means for partitioning the signal into a sequence of successive frames;

means for performing time-to-frequency transformation to obtain the spectral lines in each frame; and

means for forming bands by grouping neighboring spectral lines within each frame.

23.   (Original) The apparatus of claim 21, wherein the means for quantizing of the spectral lines further comprises:

means for estimating bit demand in each band; and

means for allocating bit based on a predetermined bit rates.

24.   (Canceled)

25.   (Currently Amended) An audio encoder comprising a quantizer coupled to a processor to calculate local gain for each scale band factor and shape quantization noise in spectral lines in each band using the local gain, wherein the local gain of ~~the~~ each band ~~are~~ is estimated as a function of band energy ratios and SMRs and to further run a loop to fit the shaped spectral lines in each band within a predetermined bit rate, ~~and~~ wherein the energy ratios are computed by

dividing energy in each band over sum of energies in all bands<u>, and wherein the local gain in</u>
<u>each scale band factor is derived using the equation:</u>

$$\underline{K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2 (SMR(b)))}$$

> <u>wherein K_b is the local gain for each scale band factor, *log2* is logarithm to</u>
> <u>*base* 2, *en(b)* is the band energy in scale band factor *b*, *sum_en* is the total energy</u>
> <u>in a frame, *SMR(b)* is the psychoacoustic threshold for scale band factor *b*,</u>
> <u>wherein *a* measure weightage due to energy ratio, and *β* is the weightage due to</u>
> <u>SMRs;</u>

a noise shaping module to shape the quantization noise in each band such that a
difference between SMR and SNR is held substantially constant in each band; and

an inner loop module to fit shaped band within the predetermined bit rate.

26.   (Original) The audio encoder of claim 25, further comprising:

an input module to partition an audio signal into a sequence of successive frames; and

a time-to-frequency transformation module to obtain the spectral lines in each frame,
wherein the time-to-frequency transformation module to form bands by grouping neighboring
spectral lines with each frame.

27.   (Canceled)

28.   (Currently Amended) An article comprising:

a storage medium having instructions that, when executed by a computing platform,
result in execution of a method comprising:

<u>calculating local gain for each scale band factor using a quantizer coupled to a processor</u>
<u>in an audio encoder; and</u>

encoding an audio signal<u> in the audio encoder</u>, based on a perceptual model, by noise
shaping spectral lines on a band-by-band basis using their local gains, wherein the local gain of
~~the~~ <u>each</u> band ~~are~~ <u>is</u> estimated as a function of band energy ratios and SMRs, such that the
difference between SMR and SNR is held substantially constant for each band, ~~and~~ wherein the

energy ratios are computed by dividing energy in each band over sum of energies in all bands,
and wherein the local gains are derived using the equation:

$$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2 (SMR(b)))$$

wherein K_b is the local gain for each scale band factor, *log2* is logarithm to
base 2, *en(b)* is the band energy in scale band factor *b, sum_en* is the total energy
in a frame, *SMR(b)* is the psychoacoustic threshold for scale band factor *b,*
wherein *a* measure weightage due to energy ratio, and *β* is the weightage due to
SMRs.

29.   (Original) The article of claim 28, wherein the local gains are derived from energy ratios
and SMRs in each band.

30.   (Canceled)

31.   (Currently Amended) A system comprising:
        a bus;
        a processor couples to the bus;
        a memory coupled to the processor;
        a network interface coupled to the processor and the memory;
        an audio encoder comprising a quantizer coupled to the network interface and the
processor to calculate local gain for each scale band factor and shape quantization noise in
spectral lines in each band using the local gain, wherein the local gain of the each scale band
factor are is estimated as a function of band energy ratios and SMRs and to further run a loop to
fit the shaped spectral lines in each band within a predetermined bit rate, and wherein the energy
ratios are computed by dividing energy in each band over sum of energies in all bands, and
wherein the local gain in each scale band factor is derived using the equation:

$$K_b = -(int)(a * log2(en(b)/sum\_en) + \beta * log2 (SMR(b)))$$

wherein K_b is the local gain for each scale band factor, *log2* is logarithm to
base 2, en(b) is the band energy in scale band factor *b, sum_en* is the total energy
in a frame, *SMR(b)* is the psychoacoustic threshold for scale band factor *b,*

wherein a measure weightage due to energy ratio, and β is the weightage due to SMRs;

a noise shaping module to shape the quantization noise in each band such that a difference between SMR and SNR is held substantially constant in each band; and

an inner loop module to fit shaped band within the pre-determined bit rate.

32.   (Original) The system of claim 31, further comprising:

an input module to partition an audio signal into a sequence of successive frames; and

a time-to-frequency transformation module to obtain the spectral lines in each frame, wherein the time-to-frequency transformation module to form bands by grouping neighboring spectral lines with each frame.

33.   (Canceled)

34.   (New) The method of claim 11, wherein shaping the quantization noise in each band using its local gain comprises:

shaping the quantization noise in each band by setting a scale factor in each band based on its psychoacoustic parameters and energy ratio.

35.   (New) The method of claim 11, wherein shaping quantization noise in each band using its local gain comprises:

shaping quantization noise in spectral lines in each band such that a difference between Signal-to-Mask Ratio (SMR) and Signal-to-Noise Ratio (SNR) in each band is substantially constant.

36.   (New) The method of claim 35, wherein the spectral lines are derived by performing a time to frequency transformation of the audio signal.

37.   (New) The method of claim 36, further comprising:

partitioning the audio signal into a sequence of successive frames;

forming bands including groups of neighboring spectral lines for each frame based on
critical bands of hearing; and

computing local gain for each band.

38.   (New) The method of claim 35, wherein shaping the quantization noise in
each band such that the difference between SMR and SNR is substantially constant comprises:

assigning a higher quantization precision to bands having a higher SMR; and

further assigning quantization precision to each band such that the assigned quantization
precision is inversely in proportion to their energy content with respect to band energy to
desensitize the bands.

39.   (New) The apparatus of claim 20, wherein the local gains are derived from energy ratios
and SMRs in each band.